## Space Weather Technical Forecast

Issued on Wednesday 5 March 2025 at 12:43 Local

**This technical forecast provides a four-day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales**

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**Space Weather Forecast Headline: M-class flares likely (R1-R2; Minor-Moderate radio blackouts) throughout. G1/G2 Day 4.**

**Analysis of Space Weather Activity over past 24 hours**

**Solar Activity:** Activity has been Moderate, with a peak flare of M1.7 at 05/1150UTC from AR4016 located in the southeast quadrant. The solar disc features eleven sunspot regions. AR4012 in the southeast is the largest region and is slowly declining. The second most notable region is AR4016 in the southeast has shown recent growth and is developing a complex magnetic structure.

No Earth-directed Coronal Mass Ejections (CMEs) were identified in available coronagraph imagery.

**Solar Wind / Geomagnetic Activity:** Solar winds, as measured by ACE at L1, are Slightly Elevated. The solar winds are gradually declining with speeds currently around 430km/s. Solar wind density was mainly below Average. However since the glancing blow from the CME, values have stabilised around Average. The Interplanetary Magnetic Field was at mostly Weak and the north-south component was rather variable and Weak. Around 04/1900UTC when a period of southward directed component was observed due to the glancing blow Coronal Mass Ejection (CME). The 24 hour period range was from +7/-8nT. The phi angle was largely positive (away from the Sun), with brief incursions to negative (towards the Sun).

The net result of the above solar wind measures was Quiet (Kp0-2) geomagnetic activity, becoming Unsettled to G1 minor storm level (Kp3-5) between 04/1800UTC to 05/0600UTC.

**Energetic Particles / Solar Radiation:** High energy proton flux (greater than 10MeV) at GOES18 was at Background.

High energy electron flux saw a rise in its diurnal oscillation, reaching High levels of 1130pfu at 03/1830UTC. The 24-hour fluence was below the Active threshold (1e8 integrated pfu), on a slightly declining trend, recording 3.93e7 integrated pfu at 05/0000TC.

**Four-Day Space Weather Forecast Summary**

**Solar Activity:** Low to Moderate levels expected, with M-class flares likely.

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**Solar Wind / Geomagnetic Activity:** There are no Earth-directed CMEs in the forecast. Slightly Elevated winds are expected to continue declining towards Background over coming days. On Day 4 (8 March) the oncoming fast wind related to CH21/- is expected to increase the solar wind to Elevated to Strong. Geomagnetic activity is expected to be Quiet to Unsettled (Kp1-3). On day 4 (8 March), periods of Active to G1/minor geomagnetic storm (Kp3-5) are likely with a chance of isolated G2/Moderate geomagnetic storm (Kp6).

**Energetic Particles / Solar Radiation:** High energy proton flux should remain at Background levels. High energy electron flux has seen diurnal rises into the high levels in the past 24 hours, with a declining trend now expected. The associated 24 hour fluence is expected to remain below the Active threshold.

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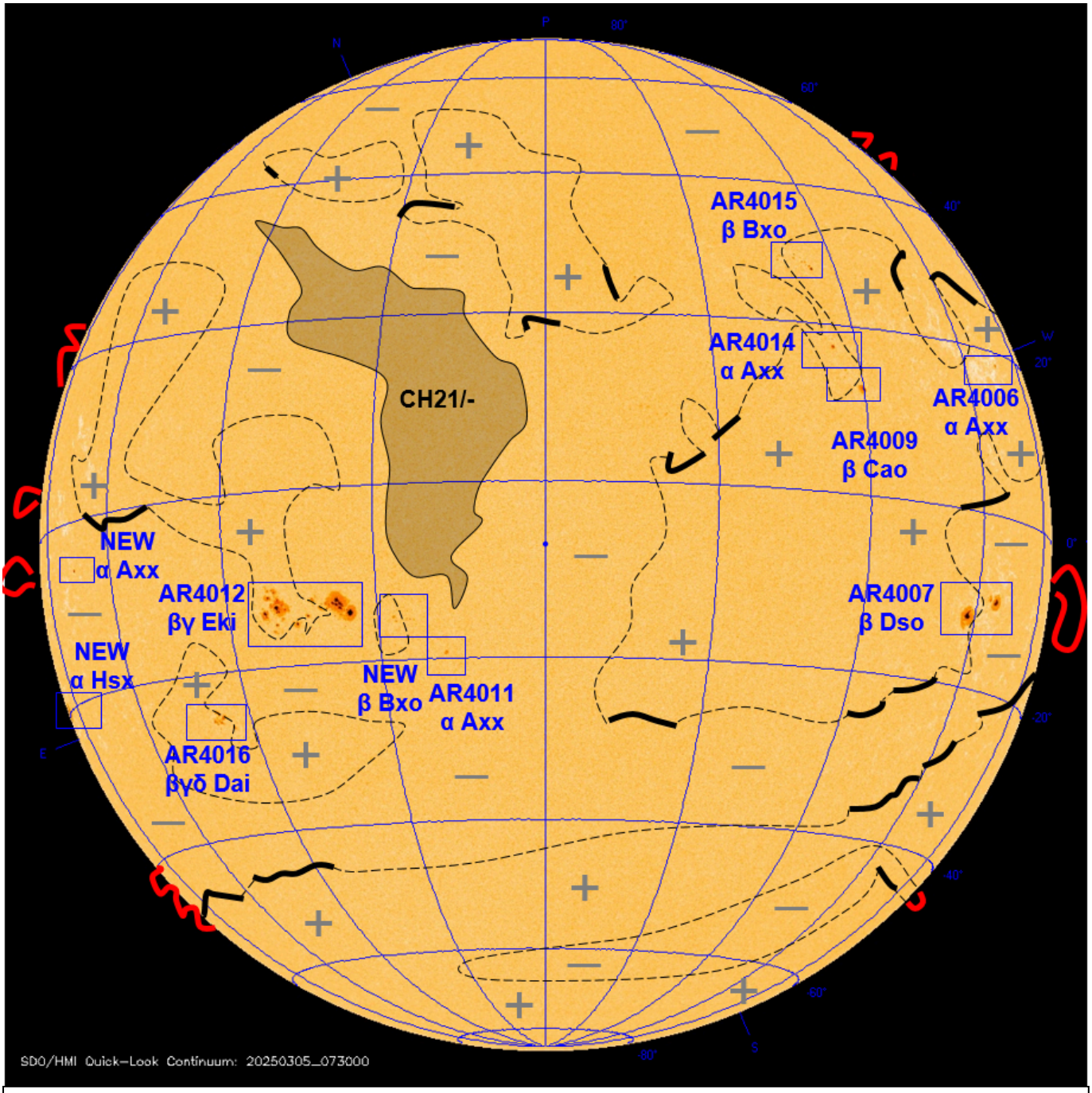
**Figure 1: Solar Synoptic Map**




**Key:** Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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## Geomagnetic Storms

There are no Earth-directed CMEs.

The High Speed Stream (HSS) influence from previous CH enhancements is expected to continue to generally wane, with Slightly Elevated winds declining towards Background over coming days. On Day 4 (8 March) the next fast wind related to a coronal hole (CH21/-) may reach Earth with Elevated to Strong wind speeds and is supported by 27 day persistence and MOSWOC Enlil.

Geomagnetic activity is expected to be Quiet to Unsettled (Kp1-3). On Day 4 (8 March), geomagnetic activity is expected to increase due to the CH enhancement from CH21/- . Given the time of year and observation of G1 minor storm on the previous rotation, periods of Active to G1/minor geomagnetic storm (Kp3-5) are likely with a chance of isolated G2/Moderate geomagnetic storm (Kp6) on day 4 (8 March).

| Geomagnetic Storm<br>Probability (Exceedance) | Level | Past 24 Hours (Yes/No) | Day 1 (00-24 UTC)<br>(%) | Day 2 (00-24 UTC)<br>(%) | Day 3 (00-24 UTC)<br>(%) | Day 4 (00-24 UTC)<br>(%) |
|---|---|---|---|---|---|---|
| Minor or Moderate | G1 to G2 | Yes | 5 | 1 | 1 | 60 |
| Strong | G3 | No | 1 | 1 | 1 | 1 |
| Severe | G4 | No | 1 | 1 | 1 | 1 |
| Extreme | G5 | No | 1 | 1 | 1 | 1 |

**Figure 2: MOSWOC Solar Wind Persistence Model**

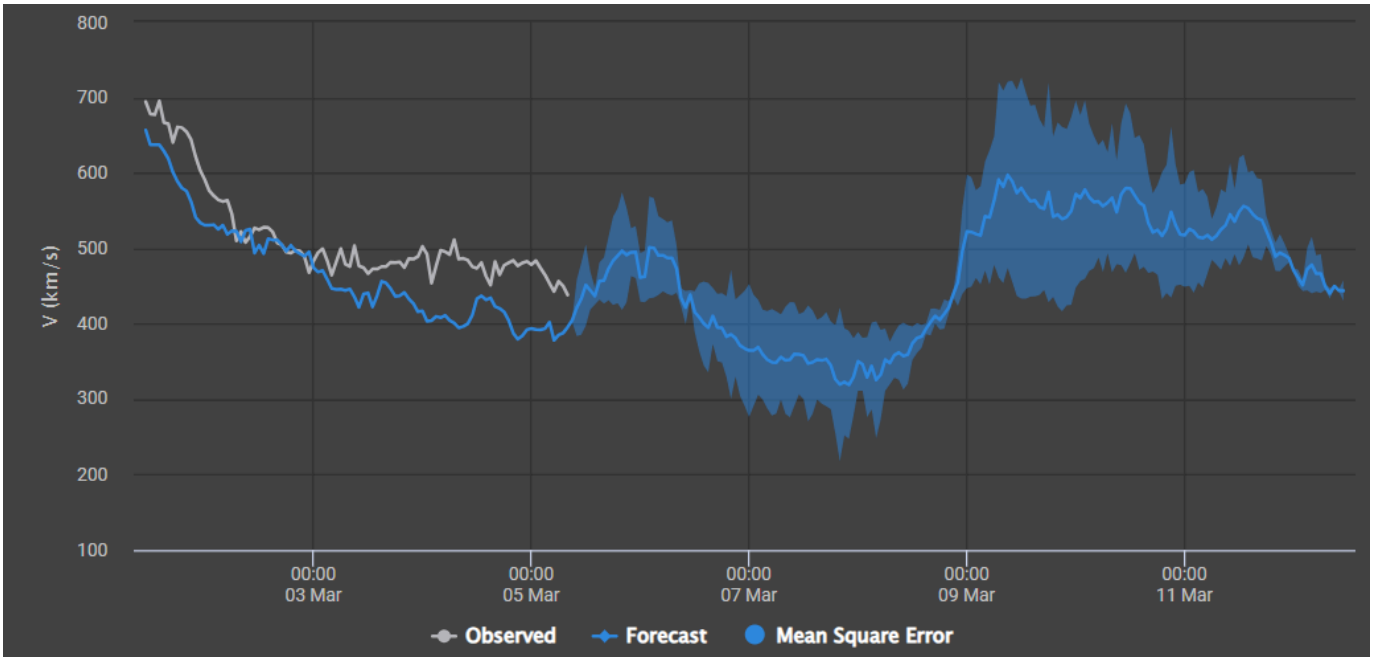


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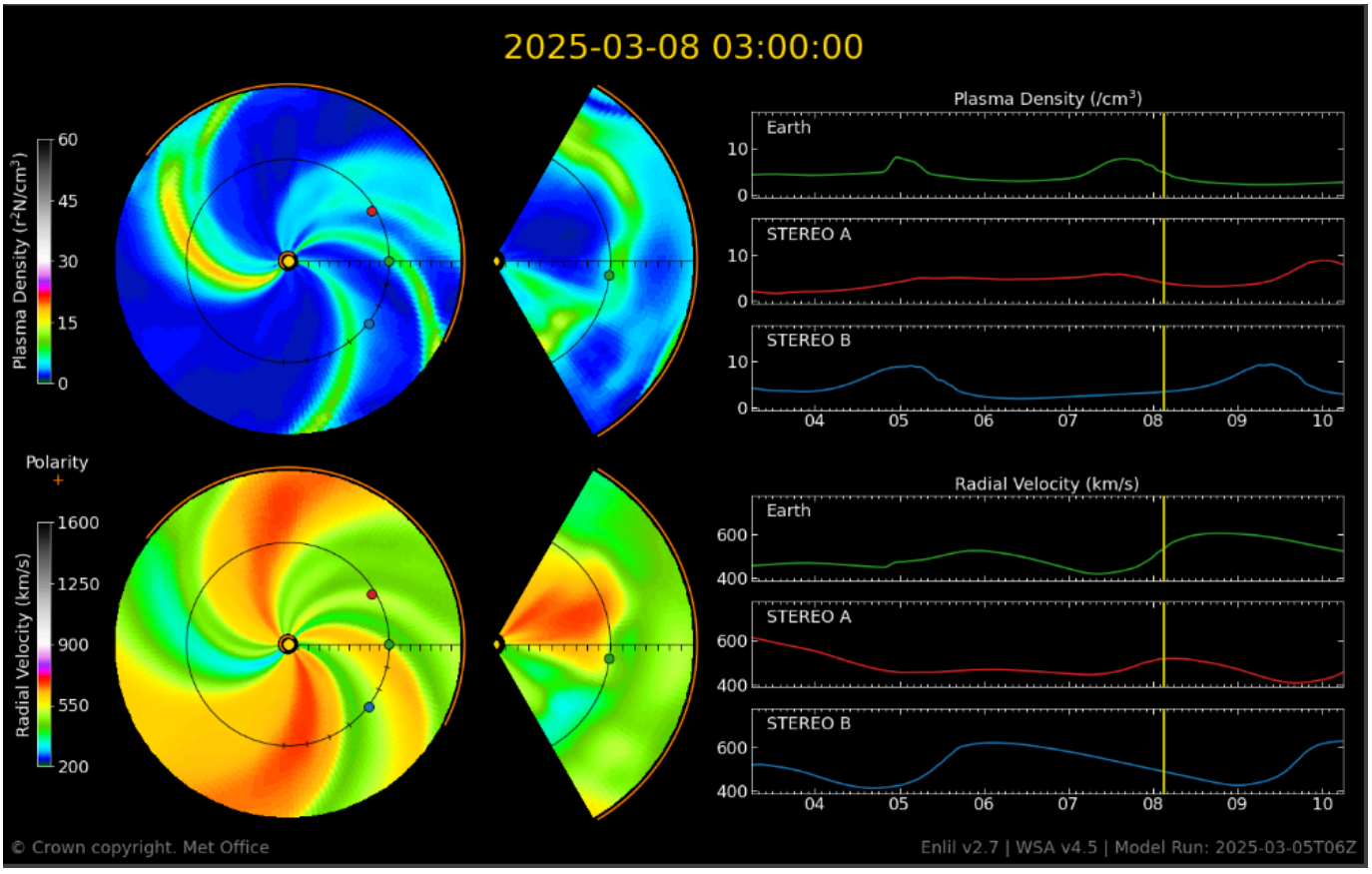
**Figure 3: MOSWOC Enlil**



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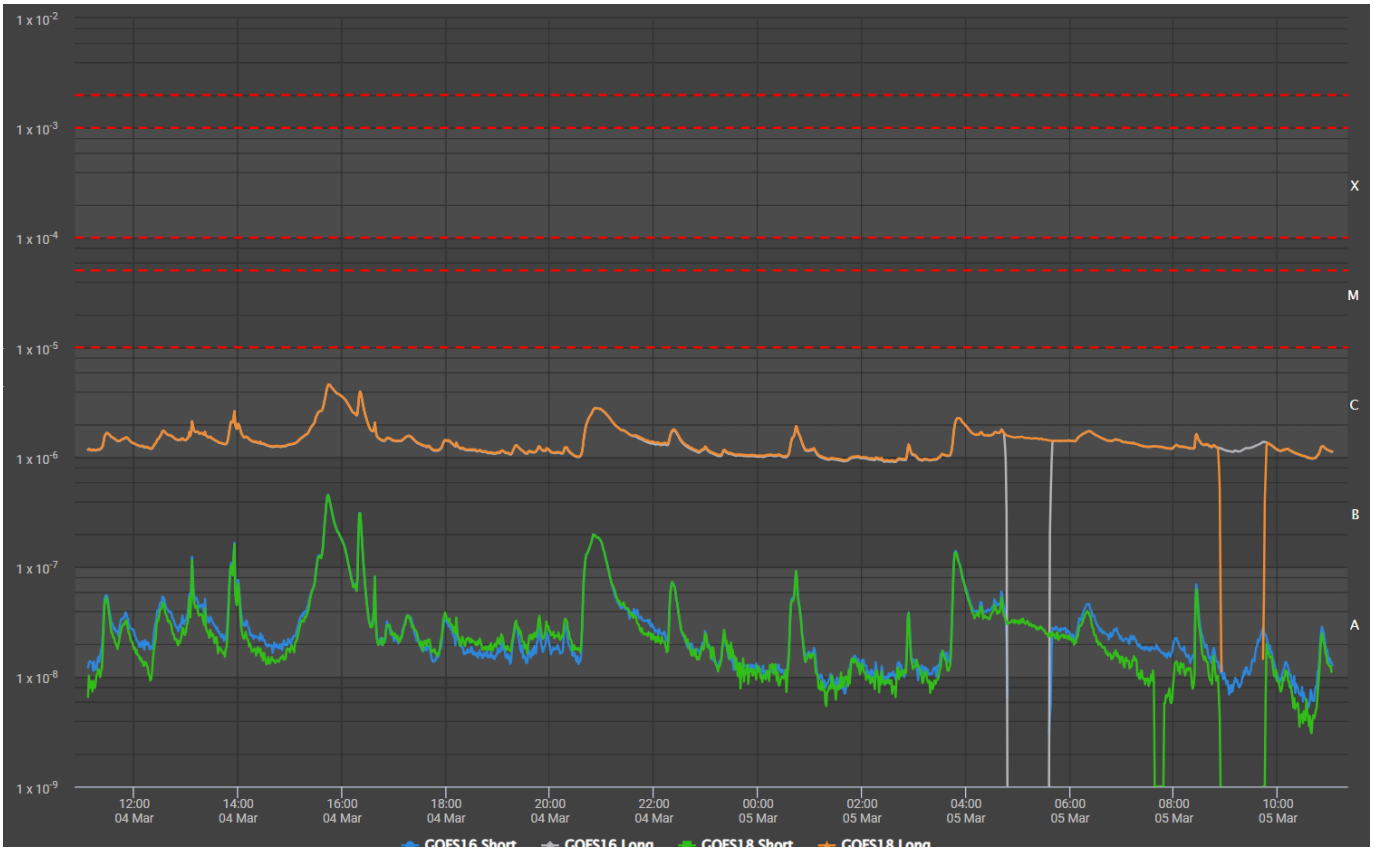
## Radio Blackouts - X-Ray Flares

Eleven sunspot regions cover the visible solar disc. AR4012 in the southeast is the largest region and is slowly declining. AR4007, the second largest region , is a relatively simple bi-polar group. AR4009 lies just south of AR4014, both regions are declining with AR014 now unipolar. AR4006 and AR4011 present as small and simple spots on the disc. AR4016 in the southeast has shown recent growth and is developing a complex magnetic structure. There are three new spots on the disc, with the spot in the far southeast showing notable magnetic looping in SDO imagery on the limb.

Solar activity is forecast to be Moderate to Low, with M-class flares likely. The main risk from AR4012 in the southeast and an increasing risk from AR4016.

| X-Ray Flares Probability | Level | Past 24 Hours (Yes/No) | Day 1 (00-24 UTC) (%) | Day 2 (00-24 UTC) (%) | Day 3 (00-24 UTC) (%) | Day 4 (00-24 UTC) (%) |
|---|---|---|---|---|---|---|
| Active | R1-R2 (M Class) | Yes | 60 | 60 | 60 | 60 |
| Very Active | R3-R5 (X Class) | No | 5 | 5 | 5 | 5 |

**Figure 4: GOES 16/18 X-Ray Flares**

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## Solar Radiation Storms (High Energy Protons)

GOES18 high energy (>10MeV) proton flux is at Background, and expected to remain at this level. There is a Slight Chance of enhancement to S1 given any significant eruption from the sunspot regions currently on the Earth-facing disc.

| Radiation Storms Probability (Exceedance) | Level ($cm^{-2}sr^{-1}s^{-1}$) | Past 24 Hours (Yes/No) | Day 1 (00-24 UTC) (%) | Day 2 (00-24 UTC) (%) | Day 3 (00-24 UTC) (%) | Day 4 (00-24 UTC) (%) |
|---|---|---|---|---|---|---|
| **Active** | **≥ S1** | No | 5 | 5 | 5 | 5 |
| **Very Active** | **≥ S3 *** | No | 1 | 1 | 1 | 1 |
| * S3 ≥ 10 MeV ≥ 1000 pfu and/or 50 MeV ≥ 10pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$) | | | | | | |

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## High Energy Electrons (≥ 2MeV)

The high-energy electron flux (>2MeV), as observed at GOES16, has been mostly Moderate but saw a very brief spell of High flux in the past UTC day. This was due to the recent charging of the outer Van Allen Belt from the fast wind enhancement from CH18/+ and/or CH19/+. Since the glancing blow from 01/1730UTC filament CME, there has been a gradual fall of flux at GOES16. Values have been fluctuating between Normal Background and Moderate which is expected to continue. No further enhancements are forecast.

The associated 24-hour fluence will probably now decline and is likely to remain below Active as indicated by MOSWOC REFM guidance output.

| GEO Electron Environment Probability (Exceedance) | Level ($cm^{-2}sr^{-1}$ $day^{-1}$) | Past 24 Hours (Yes/No) | Day 1 (00-24 UTC) (%) | Day 2 (00-24 UTC) (%) | Day 3 (00-24 UTC) (%) | Day 4 (00-24 UTC) (%) |
|---|---|---|---|---|---|---|
| **Active** | **≥ 2 MeV ≥ $1\times10^{8}$** | No | 1 | 1 | 1 | 1 |
| **Very Active** | **≥ 2 MeV ≥ $1\times10^{9}$** | No | 1 | 1 | 1 | 1 |

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**Figure 5: REFM and GOES16 Electron Flux**

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